PROPOSED STUDY PLAN

EASTMAN FALLS HYDROELECTRIC PROJECT
FERC PROJECT NO. 2457

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December 2012
# EASTMAN FALLS HYDROELECTRIC PROJECT
(FERC PROJECT NO. 2457)

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1.0 INTRODUCTION

Public Service Company of New Hampshire (PSNH) is in the process of relicensing its existing 6.4 MW Eastman Falls Hydroelectric Project (FERC Project No. 2457) with the Federal Energy Regulatory Commission (FERC). The Eastman Falls Hydroelectric Project consists of a dam and two powerhouses housing two units, located on the Pemigewasset River in Franklin, New Hampshire. PSNH is not proposing to add capacity or make any physical modifications to the Project under the new license. The current license will expire on December 31, 2017.

PSNH is using FERC’s Integrated Licensing Process (ILP) as established in regulations issued by FERC July 23, 2003 (Final Rule, Order No. 2002) and found at Title 18 of the US Code of Federal Regulations (CFR), Part 5. PSNH filed a Pre-Application Document (PAD) and Notice of Intent (NOI) to seek a new license for the Project on July 2, 2012. The PAD filed with FERC provides a complete description of the Project, including its structures, operations, and affected resources. Electronic copies of the PAD are available on FERC’s website (www.ferc.gov).

Prior to the filing of the PAD, PSNH began preparations for the relicensing of the Project by first sending out a “PAD Questionnaire” to all potential stakeholders, including the relevant Tribes and state, federal and local agencies. The questionnaire was designed to solicit existing information from the stakeholders regarding the Project and its potential effect on the environment. PSNH distributed the final PAD and NOI simultaneously to Federal and state resource agencies, local governments, Native American tribes, and others thought to be interested in the relicensing proceeding for an opportunity to review and comment. Following the filing of the PAD, FERC prepared Scoping Document 1 (SD1) and held agency and public scoping meetings and a site visit on September 18 and 19, 2012. A number of comments and information requests were provided. To the extent possible, this document intends to address those requests, but PSNH is compiling some information, as noted in Section 7, which will be
provided prior to the Study Plan Meeting. PSNH notes that corrections to the information in the
PAD were also identified by some parties, but the PAD will not be revised and reissued.
However, corrections will be incorporated as appropriate into future documents relating to the
relicensing process.

The PAD, SD1, and National Environmental Protection Act (NEPA) scoping process identified
issues associated with the existing environment for which the existing, relevant, and reasonably
available information was insufficient. The ILP requires the filing of a Proposed Study Plan
(PSP) within 45 days following the deadline for filing comments on the PAD to address
deficiencies associated with existing information.

Section 6.0 of this PSP provides the individual studies proposed by PSNH to gather additional
information needed to adequately analyze the potential effects of the continued operation of the
Project on the natural and social environments. The following studies are included in this PSP for
implementation during the 2013 field season:

1. American Eel Survey
2. Terrestrial Resources
3. Rare, Threatened and Endangered Species

Section 6.0 provides information on the goals and objectives of each study; the relationship of
the study plan to the issues identified in the PAD, SD1 and scoping process; known resource
management goals; methodology; and scope, schedule and budget information as per the
requirements of 18 CFR § 5.11.
2.0 COMMENTS ON THE PROPOSED STUDY PLAN

Comments on PSNH's PSP (including any revised information or study requests) must be filed within 90 days of filing the PSP, or by March 14, 2013. Comments must also include “an explanation of any study plan concerns and any accommodations reached with [PSNH] regarding those concerns” (18 CFR § 5.12). Further, any proposed modifications to the PSNH's PSP must address the criteria in 18 CFR § 5.9(b).

3.0 INITIAL STUDY PLAN MEETING AND ADDITIONAL MEETINGS

In accordance with 18 CFR § 5.12, PSNH will hold the Initial Proposed Study Plan Meeting required by the ILP tentatively scheduled from 10 a.m. to 12 p.m. on Wednesday, January 9, 2013 at PSNH’s Amoskeag hydro office. The purpose of the Initial Proposed Study Plan Meeting will be to clarify the intent and contents of PSNH’s PSP and resolve any outstanding issues with respect to the PSP. Additional meetings may be scheduled after the initial meeting, as necessary.

4.0 PROGRESS REPORTS, STUDY REPORTING, STUDY REPORT MEETINGS

The formal Initial Study Report is scheduled for preparation following the 2013-2014 field seasons but in no case later than one year following FERC’s approval of the final study plan. PSNH will schedule the initial study report meeting once the date for the availability of the initial study report is known. As needed, PSNH will file updated study reports within the time limits provided in 18CFR § 5.15(f).

5.0 ADDITIONAL INFORMATION REQUESTED

Comments, additional information requests and study requests were received from USFWS (October 23, 2012) and NHDES (October 30, 2012). The majority of comments centered on operational details such as generation data, pond levels and minimum flows. Similarly, FERC issued an Additional Information Request (AIR) that also sought clarification of operations and additional details about specific structures and equipment. A response to the AIR was filed with FERC on November 30, 2012. The same information is also provided in this section. Specific
information requested and status of PSNH’s efforts to compile the information is summarized below.

Several comments provided identify specific items that should be included in the PAD. PSNH notes that under FERC’s ILP process, the PAD is issued as an initial information document which is intended to present existing, relevant, readily available resource information. The PAD is not issued as a draft document that will be revised and reissued to address comments. Rather, comments will be considered and addressed through development of study plans, additional information responses, study reports, and incorporated as appropriate into the Preliminary Licensing Proposal/Draft License Application.

5.1 GENERAL COMMENTS AND CLARIFICATIONS

More specific responses to comments about project features, structures and operations are discussed in following sections. Certain comments from NHDES and USFWS are addressed below to provide clarifications.

NHDES commented about procedures associated with operation of the waste gate and presence of anglers downstream. As part of the Project Safety Plan required by FERC’s regulations under Part 12 of 18 CFR, PSNH provides warning signs clearly visible to anglers to warn of potential, rapid changes in flow. In addition, prior to opening the waste gate and generally any time unit outflow is modified, a warning siren is sounded. Prior to opening the waste gate the operator also makes a visual observation to determine if anglers are present in the tailwater area. Finally PSNH clearly marks the shoreline at a point 150 feet downstream of the dam to denote the upstream limit of fishing access in the tailwater area.

NHDES comments that the discussion of utilizing the 3Q5 flow to refill impoundments at the Merrimack River Project is incorrect and that a 90% - 10% release to refill ratio is required, and should also be required at the Eastman Falls Project. PSNH concurs with this comment. At the Merrimack River Project, during pond refilling operations, minimum flows below the project of 1,427 cfs at Amoskeag, 1,403 cfs at Hooksett, and 1,214 cfs at Garvins Falls (which equals the ABF August median flow or 0.5 cfs per square mile of drainage area) will be released at all times except when inflow is less than ABF. If inflow is less than the ABF flow, 90% of the inflow to an impoundment will be released downstream from the respective dam and 10% of the inflow to
an impoundment will be retained to refill the impoundment. If necessary, the 90%-10% flow ratio can be modified after consultation with the NHDES, USFWS and NHFGD. PSNH assumes that NHDES will include its recommendation that this ratio be utilized for refill at Eastman Falls when FERC solicits recommendations, terms, and conditions during the post-license application filing stage of the process.

USFWS recommends two fisheries management plans be adopted by FERC as Comprehensive Plans; NHDES concurs. If FERC does not adopt the plans in that manner, USFWS requests the plans be considered relevant resource management plans. However, PSNH does not agree that the “Plan for Restoration of American Shad, Merrimack River Watershed” should be considered a comprehensive or relevant resource management plan for purposes of the Eastman Falls relicensing. Citing historical authority, previous Merrimack River restoration plans concluded that while the Merrimack River and some of its tributaries historically supported shad and river herring, these fish species did not likely enter the Pemigewasset River System, instead turning east and entering the Winnepesaukee River. Given this historical background, the Restoration Plan should not be considered relevant or applicable to the Pemigewasset River. In the absence of a previous population, there is no population to be restored.

5.2 INTAKE STRUCTURES

Additional information was requested by agencies about intake structures and trashrack spacing as well as project operations relative to pond level, generation, minimum flows and run-of-river mode. FERC also requested additional details about intake gates, draft tubes and minimum unit capacities. This information is provided below as filed with the Commission on November 30, 2012.

Draft Tubes

*Unit 1:* Draft tube opening is approximately 19 feet 10 inches wide (Drawing No. 225-405) by approximately 6 feet 8 inches high (Drawing No. 225-421) and is approximately 18 feet in length (horizontally) from the turbine discharge to the tailwater opening.

*Unit 2:* Draft tube opening is approximately 23 feet wide by 14 feet 6 inches high (Drawing No. R-714-S-3.11) and is approximately 60 feet in length from the turbine to the tailwater opening with varying height and width dimensions along that distance.
Minimum Hydraulic Capacity

The minimum hydraulic capacity for Unit 1 is 250 cfs and for Unit 2 it is 700 cfs.

Headgate, Trashrack, Bulkhead Dimensions and Functions

Unit 1:

- Headgate dimensions are about 12.5 feet high by about 15 feet wide. The headgate is raised and lowered with an electric motor. (Drawing No. 225-425).
- Trashrack dimensions are 23 feet 9 1/8 inches high by 17 feet wide and consist of 1/2 inch wide bars spaced 4 inches on center for a clear spacing of 3.5 inches. (Drawing No. 225-422).
- The bulkhead is about 40 feet high and 20 feet wide with a 1 foot wide stop log slot that can be used to dewater the intake. (Drawing Nos. 225-405, 408 and 425). Tail gate panels (four 20 foot by 5.5 foot panels) can also be placed in tailrace with a crane, stacked on one another. With the panels in place and the headgate closed, pumps are used to dewater the penstock, unit and draft tube.

Unit 2:

- Headgate dimensions are about 20 feet high by about 21 feet wide. The headgate is raised and lowered with an electric motor. (Drawing No. R-714-S-4.20).
- Trashracks consist of two 12 foot 4 inch wide by 9 foot 4 inch high panels with 1/2 inch wide bars spaced 4 inches on center for a clear spacing of 3.5 inches. (Drawing No. R-714-S-4.25).

The intake stop log panel is about 20 foot 10 inches high and 22 foot 5 ½ inches wide that can be lowered into the stoplog frame of the bulkhead to dewater the intake via pumping. (Drawing Nos. R-714-S-4.14). The tail gate panel (draft tube stop logs – Drawing No. R-714-S-4.10) is 15 feet 5 inches high and 24 feet 5 inches wide and has a large pump installed in it. When the head gate and tail gates are closed the pump is turned on to dewater the intake and draft tube.

5.3 Current Operations

Operation of the Eastman Falls Project may be better described as “modified” run-of-river. Because the 410 cfs continuous minimum flow is required by the current FERC license, the project is operated first to provide that flow or inflow (whichever is less).

When inflow is insufficient to operate Unit 1 (less than 250 cfs), the unit is shut down and the minimum flow is either discharged through the waste gate or spilled over the dam. At flows
above the minimum capacity of Unit 1 (250 cfs or greater), the minimum flow is provided through unit operation.

At flows greater than 700 cfs, Unit 2 is brought on line and Unit 1 is shut down because Unit 2 is more efficient. At flows of approximately 1,830 cfs Unit 1 is brought back on line. Hydro turbines are designed to be most efficient at or near full load.

The waste gate is also operated to pass flows in excess of the hydraulic capacity of the turbines (Unit 1: 850 cfs + Unit 2: 1,930 cfs = 2,780 cfs) and to minimize overtopping of the flashboards.

If river flows increase beyond the station’s combined turbine (total station capacity of 2,780 cfs) and waste gate capacity of 6,109 cfs at a 6.0’ pond level, operating procedures instruct PSNH to remove the struts on the flashboard panels before the height of overtopping exceeds about one foot. One lowered bay of flashboards passes approximately 5,302 cfs at a 6.0’ pond level. There are three bays of flashboards. As a backup, the flashboard struts are designed to fail at two feet of overtopping so that the full spillway capacity is available during high flow conditions.

A six foot pond level (top of boards) is desired to maximize head for generation. The Project is normally operated on pond control (automated pond level control) with a set point at top of boards (6.0’). However, there are times when a dispatcher at PSNH’s Electric System Control Center (ESCC) manually controls the units. PSNH will provide generation and pond level data for the first seven days of the month for each month of 2011 in the Study Plan Filing due December 14, 2012.

Operation of the USACE Franklin Falls Dam only affects operation of Eastman Falls in that Franklin Falls has the ability to regulate inflow to Eastman Falls. During low and normal river flow conditions, Franklin Falls typically passes inflow, having no affect on Eastman Falls operation.

During periods of high flows, Franklin Falls may hold back inflow for flood control until maximum outflow levels must be released (see US Army Corps of Engineers - New England District's CD containing the Merrimack River Basin Master Manual of Water Control for the Franklin Falls, Blackwater, and Edward MacDowell Dams). The maximum discharge capacity of Franklin Falls is 18,000 cfs. When outflow from Franklin Falls is less than approximately 14,000
cfs, PSNH lowers one bay of flashboards. When discharges from Franklin Falls are between approximately 14,000 cfs and 18,000 cfs, two bays of flashboards are lowered. When flows begin to recede, PSNH raises the flashboards.

The USACE typically contacts PSNH to provide advance notice of how much water will be released during flood operations.

5.3.1 OPERATIONS TO OPTIMIZE GENERATION

Since Unit 2 is the newer and most efficient unit, PSNH operates this unit whenever possible. Hydro turbines are designed to be most efficient at or near full load. It is best to address reduced river flow by lowering the output of only one unit, rather than reducing load a little on each unit.

5.4 DESCRIPTION OF EXISTING ENVIRONMENT AND RESOURCE IMPACTS

USFWS comments that Section 4.0 of the PAD provides “very brief descriptions of the existing environment, and lacks any discussion of resource impacts.” PSNH notes that the purpose of the PAD is to summarize relevant, readily accessible existing information about resources, which is used to identify information needs and determine what, if any, additional studies may be necessary. This information will then be utilized to analyze resources impacts in the environmental analysis section of the Preliminary Licensing Proposal/Draft License Application.

5.5 GRADIENT OF DOWNSTREAM REACHES

USFWS comments that PSNH should clearly state what the mode of operations is. This issue is addressed under Section 5.3, above. PSNH is also providing information regarding pond levels and generation to illustrate typical operational conditions to maintain the headpond at six feet above the dam crest (top of boards). Appendix A provides the first week of pond level and generation data for each month of 2011 as a representative sample.

5.6 NATURALLY REPRODUCING RIVERINE FISH ASSEMBLAGE

USFWS comments that fish assemblage data provided in the PAD is 1) dated and 2) from tributaries not the mainstem of the Pemi. USFWS recommends that PSNH contact NHFGD to obtain up-to-date fisheries information. PSNH contacted NHFGD as part of its initial outreach during PAD development but did not receive a response.
Electrofishing was conducted by Normandeau Environmental Consultants, on behalf of PSNH, in the Garvins impoundment on the Merrimack River in 2010 and 2011. The following is a summary of those sampling efforts, which provides an indication of species composition in the Merrimack River downstream of the Pemigewasset River, which is approximately 29.7 miles downstream of Eastman Falls.

**TABLE 1**  TOTAL CATCH (N) AND RELATIVE ABUNDANCE (%) OF FISHES CAUGHT BY ELECTROFISH SAMPLING WITHIN GARVINS POOL DURING AUGUST AND SEPTEMBER OF 2010.

<table>
<thead>
<tr>
<th>COMMON NAME</th>
<th>GARVINS POOL</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>American shad</td>
<td>3</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>Black crappie</td>
<td>5</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Bluegill</td>
<td>45</td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td>Brown bullhead</td>
<td>2</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>Chain pickerel</td>
<td>75</td>
<td>3.1</td>
<td></td>
</tr>
<tr>
<td>Common shiner</td>
<td>4</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Fallfish</td>
<td>17</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>Golden shiner</td>
<td>1</td>
<td>&lt;0.1</td>
<td></td>
</tr>
<tr>
<td>Largemouth bass</td>
<td>560</td>
<td>23.3</td>
<td></td>
</tr>
<tr>
<td>Pumpkinseed</td>
<td>132</td>
<td>5.5</td>
<td></td>
</tr>
<tr>
<td>Redbreast sunfish</td>
<td>21</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>Rock bass</td>
<td>6</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Smallmouth bass</td>
<td>42</td>
<td>1.7</td>
<td></td>
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<tr>
<td>Spottail shiner</td>
<td>1,230</td>
<td>51.1</td>
<td></td>
</tr>
<tr>
<td>Sunfish family</td>
<td>9</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>Tessellated darter</td>
<td>45</td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td>White sucker</td>
<td>4</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Yellow bullhead</td>
<td>2</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>Yellow perch</td>
<td>204</td>
<td>8.5</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>2,407</strong></td>
<td><strong>100</strong></td>
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</table>
TABLE 2  TOTAL CATCH (N) AND RELATIVE ABUNDANCE (%) OF FISHES CAUGHT BY ELECTROFISH SAMPLING WITHIN GARVINS POOL DURING AUGUST AND SEPTEMBER OF 2011.

<table>
<thead>
<tr>
<th>COMMON NAME</th>
<th>GARVINS POOL</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Black crappie</td>
<td>6</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>Bluegill</td>
<td>103</td>
<td>6.3</td>
<td></td>
</tr>
<tr>
<td>Brown trout</td>
<td>1</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>Chain pickerel</td>
<td>88</td>
<td>5.4</td>
<td></td>
</tr>
<tr>
<td>Common shiner</td>
<td>28</td>
<td>1.7</td>
<td></td>
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<tr>
<td>Fallfish</td>
<td>58</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>Golden shiner</td>
<td>2</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>Largemouth bass</td>
<td>98</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Pumpkinseed</td>
<td>97</td>
<td>5.9</td>
<td></td>
</tr>
<tr>
<td>Redbreast sunfish</td>
<td>7</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>Rock bass</td>
<td>4</td>
<td>0.2</td>
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<tr>
<td>Smallmouth bass</td>
<td>44</td>
<td>2.7</td>
<td></td>
</tr>
<tr>
<td>Spottail shiner</td>
<td>736</td>
<td>44.8</td>
<td></td>
</tr>
<tr>
<td>Sunfish family</td>
<td>1</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>Tessellated darter</td>
<td>5</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>White sucker</td>
<td>31</td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td>Yellow perch</td>
<td>333</td>
<td>20.3</td>
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</tr>
<tr>
<td>Total</td>
<td>1,642</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

5.7  AMERICAN EEL

USFWS comments that the project configuration (intake location and rack spacing) represents problems with downstream eel passage relative to impingement and/or entrainment. USFWS also notes that installation of upstream eel passage at downstream facilities will result in more eels utilizing habitat within the project area. In order to understand the need for and timing of downstream eel passage at the Project, USFWS requests an American eel survey. This request is specifically addressed in Section 7.1.

5.8  ATLANTIC SALMON

USFWS states that Section 4.4.5 of the PAD should discuss existing measures and any effectiveness testing study results relative to Atlantic salmon passage facilities at the Project.
Because the PAD will not be revised, PSNH provides the following summary of this information: In 1994 and 1995, 175 radio tagged Atlantic salmon smolts were released to test the five possible downstream passage routes: Unit 1 turbine, Unit 2 turbine, existing downstream bypass, the wastegate and dropped flashboard on the dam crest providing about 300 cfs of surface spill. A floating louver array was in place in front of the Unit 2 intake during the studies. The study smolts exhibited weak migratory behavior and while subsequently identify downstream of the project not all the smolts were detected passing the Project. Results from the 2 years of smolt passage effectiveness testing indicated successful downstream fish passage may be accomplished using a floating louver array in front of the Unit 2 intake in combination with surface spill through a dropped flashboard panel.

5.9    WATER QUALITY ISSUES

USFWS and NHDES concur with PSNH’s proposal contained in the PAD to conduct baseline water quality data collection. Since issuance of the PAD, PSNH obtained a copy of a comprehensive USACE water quality study for the Pemigewasset River that contains results applicable to the Eastman Falls Project. Therefore PSNH has changed its original proposal to conduct a water quality study. The USACE study is summarized in Section 6, below.

5.10    WETLANDS, RIPARIAN AND LITTORAL HABITAT ISSUES

Agencies concur with PSNH’s proposal to conduct reconnaissance level surveys to confirm NWI mapping of existing wetlands at the Project.

5.11    RARE, THREATENED AND ENDANGERED SPECIES ISSUES

NHDES notes that it is not clear which exemplary communities will be surveyed to confirm locations. PSNH will confirm the locations and status of the following six exemplary communities described in Section 4.7 of the PAD, which were identified during initial consultation with New Hampshire Natural Heritage Bureau:

- Rich Mesic Forest
- Major River Silver Maple Floodplain System
- Silver Maple – False Nettle – Sensitive Fern Floodplain Forest
- Herbaceous Riverbank / Floodplain
- Aquatic Bed
- Dry River Bluff
5.12  BROOK FLOATER MUSSEL

Agencies concur with PSNH’s proposal to conduct a survey at the project to determine presence of the Brook Floater mussel.

6.0  REQUESTED STUDIES NOT ADOPTED

As per 18 CFR § 5.11(b)(4), if PSNH does not adopt a requested study, an explanation of why the request was not adopted, with reference to the criteria set forth in § 5.9(b) must be included in the PSP. The following discussion explains why certain information and/or study requests put forth have been modified or excluded from the draft study plans contained in Section 7.0 of this document.

6.1  BASELINE WATER QUALITY STUDY

PSNH originally proposed to conduct a baseline water quality study in the impoundment and tailwater area to confirm compliance with Class B water quality standards. In addition, both USFWS and NHDES agreed to PSNH proposal to conduct a Water Quality monitoring study. NHDES specified a synoptic sampling design with stations located in both upstream and downstream areas of the Eastman Falls. Sampling rounds should be scheduled using a factorial design taking into account factors such as: seasons, time of day, water temperature, air temperature, stream flow, and residence time. Sufficient sampling rounds should be collected for statistically significant comparisons between conditions. The parameters of primary interest are water temperature, dissolved oxygen, nutrients, and chlorophyll-a. Dissolved oxygen measurements should be made using programmable datasondes to ensure that representative data are collected. Sufficient data should be collected in each assessment unit such that NHDES can determine whether water quality standards for dissolved oxygen and dissolved oxygen saturation are met using the methods in New Hampshire’s Comprehensive Assessment and Listing Methodology.

After PSNH submitted the PAD and proposed a Water Quality Monitoring Study, the New England US Army Corps of Engineers published results of a comprehensive water quality monitoring study in the mainstem Pemigewasset and Merrimack Rivers upstream to Lincoln, NH, which spanned the time period from June 2009 through July 2010 (see report Executive Summary in Appendix B of this PSP). The report is available at
The objective of this field sampling program is to provide an accurate and representative picture of the current water quality conditions at sampling sites along the mainstem, with particular emphasis on impounded reaches and mouths of major tributaries. The field sampling consists of the following components:

- **Impoundment studies** – June to October, 2009 monthly samples for 5 months, vertical profiles of dissolved oxygen and temperature and water samples for total phosphorus and chlorophyll-a.

- **Continuous dissolved oxygen and temperature monitoring**- July to September, 2009 continuous monitoring of temperature and dissolved oxygen over time including daily fluctuations in dissolved oxygen levels, impacts of storm events on dissolved oxygen levels and changes in dissolved oxygen levels with varying river levels. Sampling was conducted upstream and downstream of the Eastman Falls Dam.

- **Low-flow water quality surveys (2)**- July 27, 2010 and September 21, 2010 Two low flow surveys were conducted to characterize the conditions during periods when the river is stressed with regards to dissolved oxygen.

- **High-flow water quality survey**-May 17, 2012. One high flow survey was conducted to characterize the conditions in the river during high flow.

- **Sediment Oxygen Demand and Nutrient Flux Monitoring**- September and October, 2009. Conducted in the impoundments to determine the role of sediments as contributors to dissolved oxygen deficits.

The USACOE report (2012) concludes that no stratified impoundments were detected during the five impoundment surveys. All dissolved oxygen measurement upstream and downstream of Eastman Falls were greater than 5mg/L (Class B standard).

The average total phosphorus in the Eastman Falls impoundment was less than the EPA guidance value from June through October. The average chlorophyll-a in Eastman Falls impoundment were below 1 ug/L except in September when it was less than 5 ug/L. Chlorophyll-a generally declined after dams, indicating some growth in the impoundments, however system flushing is preventing long term accumulation.

Water temperature and dissolved oxygen were measured continuously in the Eastman Falls impoundment from July through September, 2009. Measurements were recorded at 15-minute intervals and the meter was set at 25% depth from the surface. Eastman Falls impoundment continuously recorded levels of dissolved oxygen were above the percent saturation standard of 75% and the concentration standard of 5 mg/L (Figure 1). River temperatures in impoundments
fluctuated during the two-month continuous monitoring period. Impoundment water temperatures varied throughout the day with daily temperature. As a general trend, the lowest water temperature of the day occurred in the late morning, before noon. Water temperatures in impoundments tended to increase after noon and continue to increase through the evening before dropping around midnight.

**FIGURE 1** CONTINUOUS MEASUREMENTS OF DISSOLVED OXYGEN IN THE EASTMAN FALLS IMPOUNDMENT FROM JULY THROUGH SEPTEMBER, 2009 (USACOE, 2012).

During the two low flow events and the high flow event a number of parameters were measured in the Eastman Falls impoundment including carbonaceous biological oxygen demand, chlorophyll-a, dissolved oxygen, temperature, nitrogen, phosphorus, orthophosphates, pH, and bacteria. All measured parameters were within acceptable limits.

Sediment samples were also collected to measure sediment flux. Anaerobic phosphate flux release was observed at all locations, though at low levels including (<0.5 mg PO$_4^{3-}$/m$^2$ per day) in Eastman Falls impoundment. The grain size distribution by weight of sediments collected from the six impoundments and two riverine stations. In general the grain size distribution indicates a very sandy environment. The highest percentage of silt and clay was observed in the Franklin Falls impoundment (53%).

In conclusion, the parameters of primary interest to the NHDES, water temperature, dissolved oxygen, nutrients and chlorophyll-a were all measured as part of the USACOE (2012) study. NHDES recommended deployment of datasondes to continuously measure dissolved oxygen and river temperature. As part of the USACOE study, dissolved oxygen and river temperature were continuously measured for a 2-month period using datasondes. As requested in their October,
2012 comment letter sufficient data was collected in the USACOE (2012) study such that NHDES can determine whether water quality standards for dissolved oxygen and dissolved oxygen saturation were met. Going forward, a dynamic hydrologic and water quality model will be developed using data gathered from this field effort. The dynamic hydrologic and water quality model will be used to guide future management measures. PSNH believes the water quality data collected and analyzed in this topical comprehensive water quality study exceeds the level of effort experienced on similar FERC projects of this size and any additional sampling would be superfluous. Therefore, no additional water quality study is proposed associated with Eastman Falls relicensing.

7.0 INDIVIDUAL STUDY PLAN PROPOSALS

Based upon study requests submitted by agencies PSNH proposes to conduct resource studies for American eel, threatened and endangered species, wetlands and terrestrial resources (including RTE), and mussels.

7.1 AMERICAN EEL SURVEY

USFWS recommends that a study be conducted to:

1. Provide baseline data relative to the presence of American eel upstream of the Eastman Falls Dam.
2. Determine the relative abundance and distribution of American eel upstream of the Eastman Falls Dam in both riverine and lacustrine habitat.

7.1.1 EXISTING INFORMATION

As stated in the PAD, American eel are commonly encountered within the Winnipesaukee/Winnisquam watershed. Only a few American eels have been recently observed upstream of the Eastman Falls Dam (NHF&G, Donald Miller 2012 personal communication). The most upstream location for American eels from current records is from Squam Lake. A shoreline boat electrofishing survey in Newfound Lake (the Newfound River is a migratory corridor to Newfound Lake, its confluence with the Pemigewasset is located at RM 129.5) in 2011 did not indicate the presence of eels (NHF&G, Donald Miller 2012 personal communication).
7.1.2 PROJECT NEXUS

Although the Project generally operates in a modified run-of-river mode, project operation and maintenance activities have the potential to directly or indirectly affect upstream and downstream migration of American eel. Because there is little project specific information about eel presence at the Project, a survey to assess eel populations within Project waters will enable PSNH and agencies to assess potential Project effects on eel passage.

7.1.3 STUDY AREA AND STUDY SITES

USFWS requests that a survey of American eel be conducted upstream of the Eastman Falls Dam and in Squam and Newfound Lakes. As described in the PAD a study was conducted in the Newfound Lake was conducted as recently as 2011 and eels have been previously documented at Squam Lake, therefore PSNH does not agree that a survey of Newfound and Squam lakes is appropriate for the Eastman Falls Relicensing. Newfound and Squam Lakes are not located in the Project area but on upstream tributaries with no connectivity to the Project due to the presence of NHDES and privately owned dams between each lake and the Pemigewasset River. Eels are documented upstream of the Project therefore PSNH proposes to only conduct a survey of American eel presence and relative abundance in Project waters which includes the approximate nine mile segment of the Pemigewasset River extending upstream to Sumner Island in the Franklin Falls impoundment.

7.1.4 METHODOLOGY

7.1.4.1 BOAT ELECTROFISHING

Researchers will survey for American eel in the Project impoundment with a boat-mounted Smith-Root GPP 5.0 electrofishing system. Nine 1-km shoreline sampling transects will be established in a variety of habitat types (e.g., rocky shoals, shallow littoral, gravel/cobble beds, etc). Each station will be spaced at approximately 1.5-km intervals. GPS waypoints will be recorded at the start and end point of each transect.

Sampling will consist of one pass through each transect along the shoreline to a depth of approximately 2 meters. Eel will be netted and transferred to a 100-g oxygenated holding tank on board the vessel. As necessary, the approximate number and size of eel sighted outside the
electric field will be tallied. After each transect is surveyed, collected eel will be measured for length (mm) and weight (g). If an abundance of eel are collected, length and weight measurements for the first 10 individuals within discrete size classes (0-6 inches; 6-12 inches; 12-18 inches, etc) will be taken. All other eel within each discrete size class will be enumerated and a batch weight will be taken. Eel will be anesthetized¹ as needed for ease of processing and to reduce the potential for eel injury. After processing, all collected eel will be returned to the river. Any eel collected in the eel pots will be measured and weighed.

Non-target fish species (bycatch) will not be collected or processed, although anecdotal observations will be made of the species composition in the impoundment (i.e., species encountered and their observed relative abundance will be noted).

7.1.4.2 EEL POTS

Researchers will deploy of up to 9 eel pots/traps throughout the impoundment. Eel pots will be deployed in waters up to approximately 20-ft in depth at the onset of the sampling. Eel pots will be spaced at approximately 1.5-km intervals. GPS waypoints will be recorded at each eel pot location.

7.1.4.3 SURVEY TIMING AND DURATION

The survey will be scheduled to occur during the late-summer or early fall (late-August, September, or early October) to increase the likelihood of encountering more than one life stage of eel (i.e., yellow and silver).² Boat electrofishing will occur during the early evening and early morning hours (approximately 6PM to 12AM nightly). It is anticipated that two nights of boat electrofishing will be necessary to survey all 9 sample stations. Total sample time for each eel pot will be approximately 48-hours. Pots will be checked at 24-hour periods prior to retrieval.

¹ With use of clove oil or MS-222.
² Silver eel (outmigrants) typically initiate their migration during nighttime hours in the early fall when water temperatures are cooler and during periods of higher-flows (EPRI, 2001).
7.1.4.4 **ENVIRONMENTAL CONDITIONS**

The following environmental conditions will be recorded during each night of sampling: dissolved oxygen (% saturation and mg/L); water temperature; conductivity; cloud cover; and 24-hr precipitations amounts.

7.1.5 **CONSISTENCY WITH GENERALLY ACCEPTED SCIENTIFIC PRACTICE**

Survey methods are consistent with those outlined in:


7.1.6 **DELIVERABLES AND SCHEDULE**

All data collected in the field will be archived and input into an EXCEL database. Data entry will be assured for quality upon completion of data input. A data summary in tabular or graphic form will be developed and included within a brief report that describes the survey methods and findings.

7.1.7 **BUDGET**

The expected cost for the survey work is $25,000.

7.2 **RARE, THREATENED AND ENDANGERED SPECIES SURVEY, AND WETLANDS VERIFICATION**

As discussed in Section 4.7 of the PAD, the identified rare, threatened and endangered species potentially present in the project area are the brook floater mussel (known to occur downstream), four bird species and six exemplary natural communities. Project operations do not impact the four bird species or significantly impact the six exemplary natural communities, which are all located within the Franklin Falls flood control dam area. PSNH proposes to conduct a field
reconnaissance survey of the impoundment and tailwater area to determine locations and status of the exemplary natural communities.

7.2.1 GOALS AND OBJECTIVES

PSNH proposes an assessment of existing conditions for the Eastman Falls Project with respect to special-status plant and wildlife species, invasive/noxious weed populations, and wetlands. The assessment is intended to provide information pertinent to:

- Determine the type, abundance, and distribution of special status plant and wildlife species that could potentially be affected by project operations and recreational use.
- Identify and describe large patches of state-listed invasive/noxious weed populations that could potentially be spread or introduced by project operations.
- Verify locations, size, and composition of wetlands hydraulically connected to project waters identified in NWI, as well as any previously unidentified wetlands that may be influenced by project operations.

7.2.2 BACKGROUND AND EXISTING INFORMATION

Although there have been no recent vegetation, wildlife or wetland surveys at the Project, many of the species that inhabit forested, emergent and shrub wetlands, described in the PAD will also likely occur in the riparian zone, as well as species more typical of the upland forest community. The NHNHB database, and NHFGD’s Nongame Program, have identified a number of T&E wildlife and plant species within the project vicinity, as identified in the PAD.

A wetlands inventory has not been conducted for the Eastman Falls Project, however, information on the presence and character of wetlands in the area is available in the USFWS NWI database, which what provided in the PAD (Figures 4-5 through 4-7).

Concurrent with the wetlands inventory, PSNH will also conduct a survey of noxious weed species have the potential to occur in the Eastman Falls Project area.

7.2.3 PROJECT NEXUS

Although the Project generally operates in a modified run-of-river mode project operation and maintenance activities have the potential to directly or indirectly affect shorelines and riparian...
areas of the project impoundments and downstream reaches. Recreational use in and around shoreline and riparian areas can also potentially affect these resources. Such effects can alter the botanical composition of the shoreline which may have effects to wildlife habitats, wetlands, RTE species, and invasive and exotic species.

7.2.4 METHODOLOGY

PSNH proposes a survey of shoreline areas and islands within the project boundary. The survey effort will be conducted by boat during low to normal water levels (i.e., midsummer). Areas that cannot be accessed by boat will be surveyed on foot. The survey will be primarily concerned with three resource areas: wetlands and botanicals (including invasive species), RTE species, and wildlife habitats.

Wetland and Botanical Survey (Including Invasive and Exotic Species)

PSNH will employ experienced biologists qualified to identify special-status plant and wildlife species and habitats, invasive/noxious weeds, and wetlands. During field surveys, NWI maps will be used as base maps to locate known wetlands. Any new wetlands (not on NWI maps) will be sketched onto the base maps and documented using GPS. In addition to new wetlands, any wetland found to have a different extent or shape than the NWI maps will be documented and the wetlands maps can be modified accordingly.

Wetland characteristics that will be recorded in the field will include, but will not be limited to, dominant vegetation; vegetation structure and density; the types, extent and location of exotic and invasive species; soil characteristics; and hydrologic relationship to project waters. NRCS soils maps will be used to identify potential hydric soils as well as drainage type and soil permeability properties that would affect wetland vegetation. Direct and indirect indicators of wetland hydrology will be recorded (i.e., inundation, soil saturation, water marks, shallow rooting, oxidized rhizospheres, etc.). Wetlands will be photo-documented.

Rare, Threatened and Endangered Plant and Wildlife

PSNH has already consulted with NH Heritage Bureau to determine the potential presence for RTE species. This study will address plant and wildlife species using the Project’s wetland and riparian habitats. Species that have a reasonable likelihood to occur in the area and will be
included in the shoreline surveys. During the shoreline survey work, biologists will also attempt to observe and identify any special-status species (plants and wildlife) and their habitats that may be present. Field crews will document special-status species observed and/or suitable habitats identified with a GPS unit. For special-status and invasive plant species (including those that may be present in wetlands), phenology will be evaluated to determine appropriate timing of surveys to coincide with the time of year when the species are most readily identifiable (e.g., flowering and/or fruiting) during periods when multiple surveys may be conducted to locate all potential special-status species.

Finally, invasive species and their relative dominance will be noted, while surveying wetland, shoreline, and island areas. Particularly large areas (greater than 100 x 100 feet) of infestations and monocultures will be documented and mapped using GPS.

*Wildlife Habitats*

Concurrent with surveys of the project’s wetland and riparian habitats, an assessment of habitat suitability for regional flora and fauna will be performed. This assessment will include a discussion of habitat features and vegetation communities present in the study area that meet requirements for breeding, foraging and loafing for various wildlife species. Also included in this effort will be identification of any special or rare habitats, which will be documented with by GPS for coordinate mapping in GIS.

### 7.2.5 Consistency with Generally Accepted Scientific Practice

Wetlands survey procedures described above are based on standard procedures found in the ACOE wetland delineation manual (ACOE, 1987). Although wetland delineations can occur throughout the year, timing of this study will coincide with peak growth of vegetation near the end of the summer growing season. Investigators will conduct the survey during this time to describe the herbaceous plant community and produce maps that are more accurate.

Anecdotal documentation of wildlife species and habitats; potential T&E species and habitats; and invasive and aquatic species observed during the performance of the wetlands survey and other studies is an accepted means of documenting species use of the project.
7.2.6 **Deliverables**

Data and analyses from this study will be included in a formal terrestrial resources report. Deliverables will include a short report summarizing the existing conditions (including descriptions, species lists, etc.) and of wetlands, botanical resources, wildlife habitats, invasive and exotic species, and T&E species. Documentation abundance, distribution, and habitat use of observed species will be included. Updated wetlands, T&E species maps, and invasive weed location maps, as well as maps showing areas of significant wildlife habitats will also be provided. Completed wetland function and value evaluation forms and supporting documentation are to be included as an appendix to the report. The final report will be provided as part of the Initial Study Report document.

7.2.7 **Schedule**

The surveys will be conducted during the 2013 field season. The report will be included in the Initial Study Report document, tentatively due to agencies and FERC for review in the spring of 2014.

7.2.8 **Budget**

PSNH estimates the cost of collecting the data; analyses including mapping; and reporting as approximately $40,000.

7.3 **Brook Floater Mussel**

7.3.1 **Goals and Objectives**

Specific goals and objectives identified in study requests include:

- Characterize the relative abundance and distribution of freshwater mussels and habitat suitability in the area affected by project operations.
- Map and survey for brook floater in project area.
- Identify potential areas that could support brook floater and assess variables that may be affecting distribution.
7.3.2 BACKGROUND AND EXISTING INFORMATION

Limited information regarding freshwater mussel species is available for the project area.

7.3.3 PROJECT NEXUS

PSNH is not proposing to change operations at the Eastman Falls development which will not result in any new effects on existing resources. However, PSNH proposes to conduct a field reconnaissance survey of the impoundment and tailwater area to determine if the brook floater mussel is present in the area to assess if operations may affect existing populations.

7.3.4 METHODOLOGY

PSNH proposes to search riverine habitat downstream of the Eastman Falls dam to the confluence with the Winnipesaukee River to determine the location of brook floater populations. Searches will be conducted in wadeable, flowing water habitats with sand and gravel substrates, such as tailwaters and bypass reaches. Biologists experienced at identifying brook floaters and their habitat will search along the riverine substrate by foot and snorkeling to a maximum depth of 5 feet. Detailed field notes will be kept in a waterproof field notebook, which will identify the location of brook floaters encountered during the survey; presence of other mussel species encountered during the survey may be recorded as ancillary information. In addition, shell middens along the shoreline will be searched for brook floater shells. The biologists will identify locations of brook floaters in riverine habitats within the project developments; however, no attempt will be made to quantify the size of the populations that are found.

7.3.5 CONSISTENCY WITH GENERALLY ACCEPTED SCIENTIFIC PRACTICE

Proposed survey methods are consistent with agency approved methods at other hydroelectric projects in the region during the past few years.

7.3.6 DELIVERABLES

Data and analyses from this study will be included in a summary report as part of the Initial Study Report document. The summary will summarize the species and habitats encountered in the Proctor impoundment. Captioned photographs of typical and/or significant habitat conditions
will be included in the report, as well as maps locating any species populations found during the field survey.

7.3.7 Schedule

Field study will occur during the summer of 2013.

7.3.8 Budget

PSNH estimates the cost of collecting the data; analyses including mapping; and reporting as approximately $20,000.

7.4 Relevant Comprehensive Waterway Plans

Section 10(a)(2)(A) of the Federal Power Act, 16 USC § 803(a)(2)(A), requires FERC to consider the extent to which a project is consistent with Federal or State comprehensive plans for improving, developing, or conserving a waterway affected by the project.

FERC Order No. 481-A, issued on April 27, 1988, established that FERC will accord FPA Section 10(a)(2)(A) comprehensive plan status to any Federal or State plan that:

1. Is a comprehensive study of one or more of the beneficial uses of a waterway or waterways;
2. Specifies the standards, the data, and the methodology used; and
3. Is filed with the Secretary of the Commission.

FERC currently lists 25 comprehensive plans for the State of New Hampshire, 13 of which pertain to waters in the vicinity of the Project.

- National Marine Fisheries Service. 1998. Final Amendment #11 to the Northeast Multi-species Fishery Management Plan; Amendment #9 to the Atlantic sea scallop Fishery Management Plan; Amendment #1 to the monkfish Fishery Management Plan; Amendment #1 to the Atlantic salmon Fishery Management Plan; and Components of the


In addition to the qualifying Federal and State comprehensive waterway plans listed above, some agencies have developed resource management plans to help guide their actions regarding specific resources of jurisdiction. The resource management plans listed below may be relevant to the Project and may be useful in the relicensing proceeding for characterizing desired conditions.

- Pemigewasset River Corridor Management Plan - developed by the Pemigewasset River Local Advisory Committee and finalized in 2001.
APPENDIX A

HEADPOND LEVEL AND GENERATION DATA
Eastman Falls Project (FERC No. 2457), Headpond Level and Generation for 1/1/2011 through 1/7/2011
Eastman Falls Project (FERC No. 2457), Headpond Level and Generation for 2/1/2011 through 2/7/2011
Eastman Falls Project (FERC No. 2457), Headpond Level and Generation for 7/1/2011 through 7/7/2011
Eastman Falls Project (FERC No. 2457), Headpond Level and Generation for 10/1/2011 through 10/7/2011
Eastman Falls Project (FERC No. 2457), Headpond Level and Generation for 11/1/2011 through 11/7/2011
Eastman Falls Project (FERC No. 2457), Headpond Level and Generation for 12/1/2011 through 12/7/2011
APPENDIX B

EXECUTIVE SUMMARY OF UPPER MERRIMACK RIVER WATERSHED ASSESSMENT STUDY
Executive Summary

The Upper Merrimack River Watershed Assessment Study is a jointly funded effort between local communities, state, and Federal partners. Partners include: the New Hampshire Department of Environmental Services, the U. S. Army Corps of Engineers, New England District, the Environmental Protection Agency (which is providing technical assistance) and the Southern New Hampshire Planning Commission (which is providing facilitation and management assistance).

This study is authorized by Section 729 of Water Resources Development Act (WRDA) of 1986 entitled “Study of Water Resources Needs of River Basins and Regions” as amended by Section 202 of WRDA 2000 and by Section 437 of WRDA 2000 entitled “Merrimack River Basin, Massachusetts and New Hampshire.”

The Merrimack River is formed by the confluence of the Pemigewasset and Winnipesaukee Rivers in Franklin, New Hampshire. The River flows southward in NH and turns at the NH-MA border and flows in a northeasterly direction discharging to the Atlantic Ocean at Newburyport, MA. The watershed is about 5,010 square miles and about 3,900 square miles are in NH.

The study area for the Upper Merrimack and Pemigewasset River Study is the mainstem Pemigewasset (54 miles) and the Merrimack River in NH (66 miles). There is an additional 50 miles of river in MA not specifically modeled as part of the NH study. Six dams are included in the study area:

- Ayers Island Dam in Bristol/New Hampton
- Franklin Falls Dam in Franklin
- Eastman Falls Dam in Franklin
- Garvins Falls Dam in Concord/Bow
- Hooksett Dam in Hooksett
- Amoskeag Dam in Manchester

Franklin Falls Dam is owned and operated by USACE and is used primarily for flood control purposes while the other dams are owned and operated by Public Service Company of New Hampshire and are used for hydroelectric power generation.

The study includes sampling and analysis of water quality and river flows and development of a computer model capable of assessing existing and future water quality conditions. The three major components of the model are: watershed runoff and loading, hydraulic routing, and water quality simulation.

The models are being calibrated with data collected as part of the study and other available data. The Sampling sites for the study are shown in Figure 1.

For more information, please contact the Project Manager, by e-mail.